TECHNOLOGY DEVELOPMENT FOR A LONG DURATION, MID-CLOUD LEVEL VENUS BALLOON

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ABSTRACT

This paper describe the results of ongoing technology development activities for a Venus spherical superpressure balloon capable of flying for long durations (30 days) in the middle cloud layer at an altitude of 55 km. Data is presented from a successful aerial deployment and inflation flight experiment on a 5.5 m diameter prototype balloon conducted at a 2.5 km altitude on Earth. Although the balloon in that test was not released for free flight, all other steps in the deployment and inflation process were successfully executed. Experimental and computation results are also presented from an investigation of the stress concentration phenomenon at the junction of the metal end fitting and fabric end cap of the Venus balloon. Results are also presented from sulfuric acid exposure experiments on a number of plastic films that could serve as an improved outer protective layer over the Teflon FEP film previously used. It was discovered that although some films are not damaged by the acid, they are permeable and allow acid penetration over multi-day time scales. Aclar film was found to be both unaffected and impermeable to sulfuric acid and therefore was selected as the protective outer layer in a new balloon laminate material. Experimental results are presented for mechanical, optical and sulfuric acid resistance properties of this new laminate, and from testing of a 3.5 m diameter (half-scale) prototype balloon.